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Statistics and Scaling of Turbulent Couette-Poiseuille Flows at the Verge of Separation ZEHUAN WU, Laboratory for Turbulence Research in Aerospace and Combustion, Department of Mechanical and Aerospace Engineering, Monash University, ATSUSHI SEKIMOTO, Division of Chemical Engineering, Department of Materials Engineering Science, Graduate School of Engineering Science, Osaka University, Osaka 560-85, CALLUM ATKINSON, JULIO SORIA, Laboratory for Turbulence Research in Aerospace and Combustion, Department of Mechanical and Aerospace Engineering, Monash University — Turbulent Couette-Poiseuille (C-P) flows with zero mean skin friction in adverse pressure gradients (APG) are investigated using direct numerical simulation (DNS). The aim of this study is to characterize the flow behaviour and investigate appropriate scaling laws when this flow is at the verge of separation. Four DNSs different Reynolds number were performed. All DNSs have approximately zero mean skin friction on the stationary bottom wall, while the moving top wall provides strong wall shear. Profiles of the mean streamwise velocity U are presented using different velocity and length scales to investigate the appropriate scaling for the C-P flow The attached flow on the moving wall behaves similar to canonical channel flow. The friction-viscous scales, u_τ and l_τ, provide the proper scaling of the mean velocity. In contrast to the flow on the shearless (stationary) wall, the friction-viscous scales are not applicable. Instead, pressure-viscous scales, u_P and l_P, provide the appropriate scaling of the mean streamwise velocity with a square-root law observed. In the outer layer, collapsed profiles of the mean streamwise velocity are observed in outer scales that we developed using the approach similar to Zagarola Smits (1998).

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